

(U.S. Patent No. 5,753,418). The reasons for the rejection are set forth in paragraph 2, on pages 2-3 of the Official Action.

This rejection is respectfully traversed for the following reasons:

- (1) The combination proposed in the Official Action renders the invention of Abraham unsatisfactory for its intended purpose;
- (2) The combination proposed in the Official Action improperly changes the principle of Abraham's invention;
- (3) The combination proposed in the Official Action is improper due to the lack of reasonable expectations of success; and
- (4) Tsai teaches away from the proposed combination.

As set forth in MPEP § 2142, to establish a *prima facie* case of obviousness, three basic criteria must be met:

- i. There must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings;
- ii. There must be a reasonable expectation of success; and
- iii. The prior art reference (or references when combined) must teach or suggest all the claim limitations.

Further, the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

In the rejection, the Examiner proposes to modify Abraham by (1) substituting the organic ARC of Tsai for Abraham's inorganic Ti based ARC and (2) using Abraham's etching gas chemistry for the Ti based inorganic ARC to etch the substituted organic ARC.

(1) Lack of Motivation Because Proposed Modification Renders Abraham's Invention Unsatisfactory for its Intended Purpose

The rejection is improper because the modification of Abraham proposed by the Examiner renders the invention of Abraham unsatisfactory for its intended purpose. That is, if a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). See MPEP 2143.01.

In the present case, Abraham discloses the use of a specific combination of etching agents for use with a TiN ARC to achieve desired selectivity with respect to an overlying photoresist and an underlying aluminum layer. Abraham's invention was intended to overcome deficiencies of prior etching techniques of etching TiN ARC layer materials (See Column 7, Lines 47-64 of Abraham). Substitution of an organic ARC layer for the inorganic Ti based ARC layer of Abraham would defeat Abraham's intended purpose of providing an etchant chemistry with a high selectivity of the TiN ARC layer etch rate versus the photoresist etch rate. As such, the rejection is improper and should be withdrawn.

In the final Official Action, the Examiner only commented on Applicant's previously submitted arguments relating to the requirement for a reasonable expectation of success, above point (3). Because the Examiner has not addressed the present point (1), the

rejection is not supported by all three of the basic criteria set forth in MPEP § 2142 .

Namely, there is no suggestion or motivation to combine the reference teachings as proposed in the Official Action. As one of the basic criteria for a *prima facie* case of obviousness is lacking for the reasons explained above, the rejection is untenable and should be withdrawn.

(2) Lack of Motivation Based on Change of Principle of Abraham's Invention

The modification of Abraham proposed in the Official Action impermissibly changes the principle of operation of the invention of Abraham. That is, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). See MPEP 2143.01.

In Abraham, the use of a specific combination of etching agents for etching Ti based inorganic anti-reflective coating layers is disclosed. As explained above, Abraham's invention sought to improve etch rate selectivity of the TiN ARC to the overlying photoresist and underlying aluminum layer. An organic ARC is a polymer based composition like Abraham's photoresist. Because substitution of an organic ARC layer for the inorganic Ti based ARC layer of Abraham would change the principle of operation of Abraham's invention, the rejection is improper since it is not supported by one of the three criteria required to establish a *prima facie* case of obviousness.

As mentioned above, in the final Official Action, the Examiner only commented on point (3). Because the Examiner has not addressed the present point (2), the rejection is not supported by all three of the basic criteria set forth in the MPEP. As one of the basic criteria for a *prima facie* case of obviousness is lacking for the reasons explained above, the rejection is improper and should be withdrawn.

(3) Lack of Reasonable Expectation of Success

Item (ii) of the three basic criteria required for a proper 35 U.S.C. §103 rejection relates to the showing of a reasonable expectation of success. As explained below, the combination proposed in the Official Action is improper because the Official Action has failed to establish the required reasonable expectation of success of using Abraham's etch chemistry for etching Tsai's organic ARC.

The etch chemistry employed by Abraham is specifically chosen based on its ability to selectively etch a Ti based inorganic ARC material vis-a-vis an overlying photoresist and an underlying aluminum layer. Abraham, for example, discloses that the etch chemistry has an "exceptional ability to etch TiN ARC layer materials" (See Column 7, Lines 49-50 of Abraham). Abraham further discloses that the etchant achieves a desired etch rate selectivity of a TiN ARC to photoresist and TiN ARC to an underlying aluminum layer (See Column 7, Lines 46-51, Column 8, Lines 43-44 and 50-64 of Abraham).

Abraham's etch chemistry is chosen to achieve etching of Ti based inorganic ARC materials with minimum etching of polymer photoresist materials. Because an organic

(i.e., polymer) ARC is similar in chemistry to a polymer photoresist, a person of ordinary skill in the art would not have had a reasonable expectation of success in etching an organic (polymer) ARC with the desired selectivity to a polymer photoresist. As pointed out earlier, the prior art establishes that organic and inorganic ARC materials are etched with completely different etchant gases. The Examiner has not identified any prior art reference establishing a reasonable expectation that an organic ARC can be successfully etched with a TiN etchant gas, nor has the Examiner established that the selectivity desired in Abraham could still be achieved when etching Tsai's organic ARC with Abraham's TiN etching gas. As such, the Official Action fails to establish the required reasonable expectation of success for the proposed combination of Abraham and Tsai.

In the Response to Arguments section of the Official Action, which appears in numbered paragraph 5, on page 5 of the Official Action, the Examiner contends that ". . . the reference of Abraham discloses that the first chemistry etching of CHF₃, Chlorine and an inert gas of Ar (col 6, lines 34-36) used to etch an inorganic ARC of TiN may also be performed on **any** metallization- overlaying layer [paragraph 5 of the Official Action, emphasis in original].

The section of Abraham referred to above, however, reads as follows:

. . . the anti-reflective layer of the layer stack *is etched with a first chemistry* . . . this first chemistry etching may also be performed, *in certain layer stack structures*, on any metallization-overlaying layer, e.g., *adhesion layer, seed layer*, or the like. . . [Column 6, lines 8-17 of Abraham, emphasis added]

Abraham, however, then goes on to state:

. . . this overlaying layer may be formed either of Ti, TiN, TiW or a material that is mainly titanium. . . the first chemistry for a TiN anti-reflective layer etch may include any one of the group consisting of Cl₂/Ar/CHF₃, Cl₂/CHF₃/BCl₃, Cl₂/CHF₃, Cl₂/N₂, Cl₂/N₂/CHF₃, Cl₂/HCl/CHF₃, and Cl₂/N₂/BCl₃. [Column 6, lines 18-37 of Abraham, emphasis added]

The above passage of Abraham clearly conveys that, although the metallization-overlaying layer may in certain instances be a layer other than an ARC layer (e.g., an adhesion layer or a seed layer), the specific first chemistry disclosed by Abraham is intended for use with a TiN ARC. Accordingly, it is respectfully submitted that the Official Action fails to establish the required reasonable expectation of success.

(4) Tsai Teaches Away From the Proposed Combination

It is well established that a prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984). See MPEP §2141.02.

Tsai discloses using a different etch chemistry for etching an organic ARC than that employed by Abraham for etching a TiN ARC. Tsai, for example, discloses an etchant gas composition comprising carbon tetrafluoride and argon for etching the organic ARC (Column 6, Lines 52-54 of Tsai). Although it would not have been obvious to substitute Tsai's organic ARC for the TiN ARC of Abraham, such a substitution would also have necessitated substituting Tsai's organic ARC etchant gas in place of Abraham's etchant gas,

thus teaching away from the claimed process. Because Tsai teaches away from the claimed process, the Examiner has therefore failed to establish a *prima facie* case of obviousness.

In view of the foregoing, it is submitted that the claimed process is clearly patentable over the combination of Abraham and Tsai.

- II -

Claims 16 and 19 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Abraham in view of Tsai and further in view of Bariya. The reasons for the rejection are set forth in paragraph 3, on pages 3- 4 of the Official Action.

As set forth in the Official Action, Bariya is relied upon merely for its background mention of polyimide as an organic ARC. Bariya, however, fails to cure the aforementioned deficiencies of Abraham and Tsai since the combination thereof fails to disclose the claimed process comprising exposing the exposed areas of an organic ARC to an oxygen-free system of etching agents in an ionized state in a reaction chamber of a plasma generating device, the system of etching agents including one or more fluorine-containing compounds, chlorine and an optional inert carrier gas. Accordingly, withdrawal of this ground of rejection is respectfully traversed.

Further, Bariya also teaches away from the combination proposed in the Official Action. In particular, Bariya discloses using a different etch chemistry than that employed by Abraham. Bariya, for example, discloses an oxygen plasma for etching the organic ARC (Column 5, Lines 9-12 of Bariya). Although it would not have been obvious to

substitute Bariya's organic ARC for the TiN ARC of Abraham, such a substitution would also have necessitated substituting Bariya's organic ARC etchant gas for Abraham's TiN ARC etchant gas, thus teaching away from the claimed process. Because Bariya teaches away from the claimed process, the Examiner has failed to establish a *prima facie* case of obviousness.

- III -

Claims 5 and 13 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Abraham in view of Tsai and further in view of the assertion that "one skilled in the art would have found it obvious to employ any of a variety of gas flow rates including those claimed by the applicant because etchant flow rate is a well known variable in the plasma etching art which is known to effect [sic] the plasma etching process" and that "the selection of particular flow rates would simply involve routine experimentation". The reasons for the rejection are set forth in paragraph 4, on page 4 of the Official Action. The rejection is traversed for the following reasons.

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). The mere fact that references can be combined or modified does not render the resultant

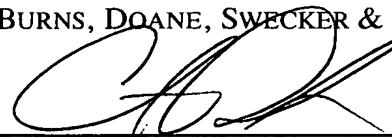
combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). See MPEP 2143.01. As explained above, it would not have been obvious to substitute an organic ARC for Abraham's inorganic ARC because: (1) the result would render Abraham's invention unsuitable for its intended purpose; (2) the result would improperly change the principle of Abraham's invention; (3) there is no reasonable expectation of success; and (4) the result goes against the teachings of Tsai. However, if Abraham's ARC was replaced with Tsai's organic ARC, one of ordinary skill would have also replaced Abraham's etchant gas with Tsai's etchant gas in which case (1) Tsai's etchant gas would not suggest the etchant gas used in the claimed process and (2) optimization of the flow rates thereof would not suggest the features of Claims 5 and 13. Accordingly, withdrawal of this ground of rejection is respectfully requested.

Applicants submit that the differences between the claimed subject matter and the prior art are such that the claimed subject matter, as a whole, would not have been obvious at the time the invention was made to a person having ordinary skill in the art.

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In view of the foregoing, Applicants submit that the present application is in condition for allowance and such action is earnestly solicited.

Respectfully submitted,
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